

Nebraska Public Power District Methane Recovery Workshop

**Colorado Governor's Office of Energy
Management and Conservation**



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Deputy Director
June 19, 2002**

Office of Energy Management and Conservation Overview

- Serves people of Colorado through the demonstration of and education about viable, real-world energy solutions
- Federally funded; No Colorado tax dollars
- Founded in 1977

FOR MORE INFO...

Colorado Governor's Office of Energy Management and Conservation: www.state.co.us/oemc or (303) 894.2383

Colorado Pork, LLC. Lamar, CO



- **Constructed in 1999**
- **A typical breed-to-wean CAFO with 5,000 sows and 16,000 piglets**
- **Built to be both an energy- and water-efficient CAFO**
- **Immediately impacted by Colorado Constitutional Amendment #14**

Colorado Pork's Anaerobic Digester

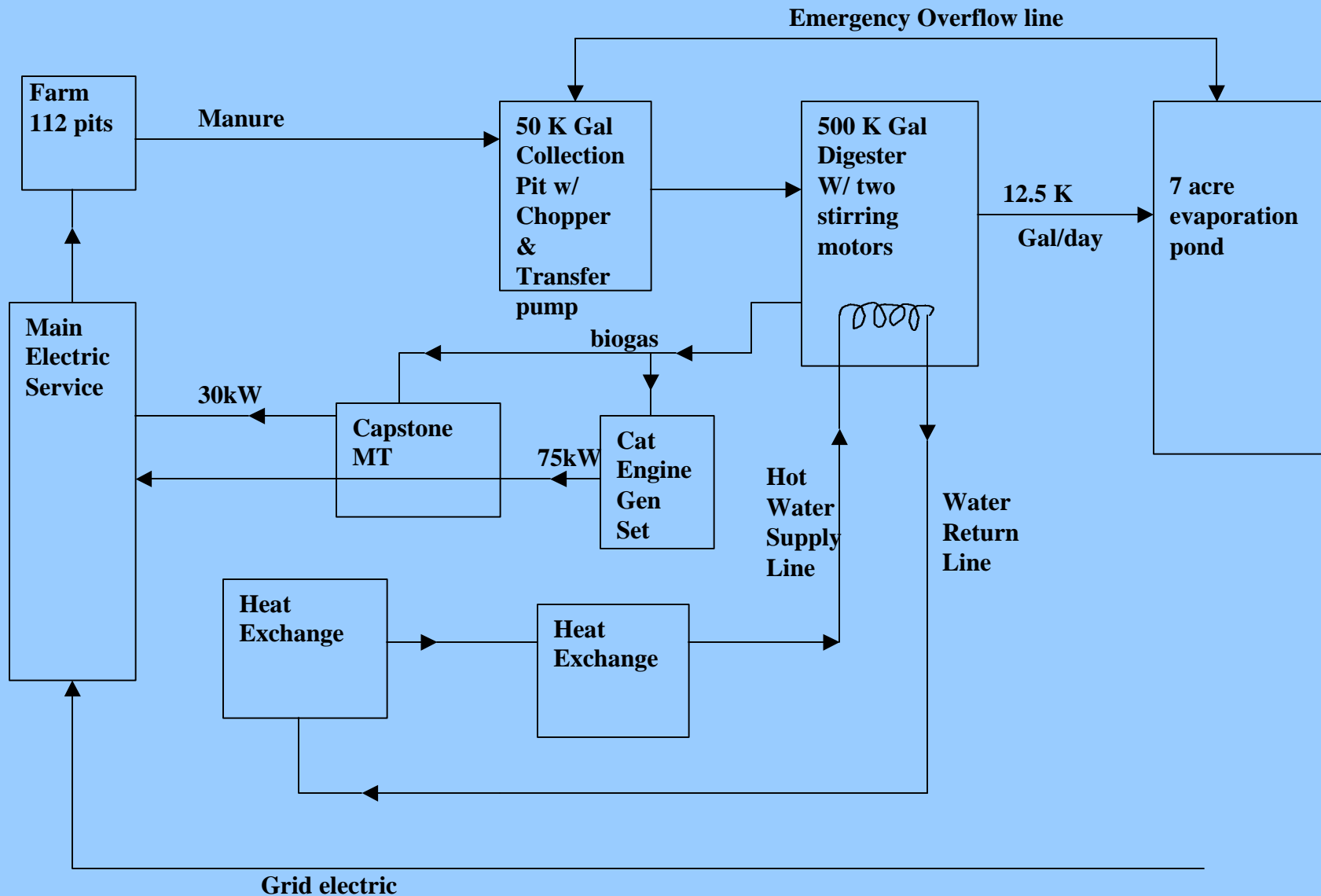
- Atypically, it is a USEPA AgStar Partner Farm with a complete mix, manure biogas anaerobic digestion (AD) system
- AD consists of a 50,000 gallon storage pit and 500,000 gallon digestion chamber





- **Biogas produced is burned in a modified natural gas internal combustion, reciprocating engine with a generator set**
- **Gas not utilized is flared**

Colorado Pork LLC Waste System Schematic





Biogas primary constituents*:

**Approximate figures*

- **66% methane (with approximate BTU value of 661 per cubic foot)**
- **31% CO₂**
- **0.6% H₂S**



Anaerobic Digester reduces*:

**Approximate figures*

- **Volatile acids by 89%**
- **COD by 71%**
- **BOD by 82%**
- **Fecal coliform by 99.9%**
- **Volatile solids by 65%**

Colorado Pork Generator



Colorado Pork generator is:

- **Parallel-tied to the grid**
- **Able to run independently while farm receives grid-produced electricity to meet needs above on-site production**

Electrical Consumption

- **Generator produces approx 35% of farm's kWh and 50% of its peak power**
- **Colorado Pork pays approx \$3,500 for electricity/month**
- **Other local hog CAFOs of equivalent size pay between \$10,000 - \$11,000 per month**



Electrical Interconnection

- **Interconnection for two-way transmission is in the works**
- **Currently the REC shuts down or throttles back the engine if any power tries to enter the grid**



COMPARATIVE COST ANALYSIS FOR A 5000 SOW FARM

SYSTEM TYPE	ACTUAL CONSTRUCTION COSTS TO NEAREST \$500	NET ELECTRICITY COSTS SAVED PER YEAR
Single Cell Lagoon	\$301,500	Zero
Two Cell Lagoon	\$357,500	Zero
Covered Single Cell Lagoon	\$476,500	Zero
Covered Two Cell Lagoon	\$473,500	Zero
Anaerobic Digester (w/ small scale single cell lagoon and 75kW genset)	\$375,000	\$40,000 (if \$.0675/kWh)
Retrofit To Add AD and Genset For Any Of First Four Above	Additional \$250,000, approximately	\$40,000 (if \$.0675/kWh)

Micro Turbine (MT) Installation

- A Capstone 30kW micro turbine & co-generation device were installed in October 2001



Micro Turbine Technology is New to Agriculture

Colorado Pork MT:

- **1st in the world to use biogas on a hog farm**
- **1st in Americas to use biogas in an active Ag setting**
- **3rd in the world in any Ag setting**
 - **2nd was on a dairy farm in Japan**
 - **1st was in England on a research farm, which has since been moved from original site to a new Ag research facility**

Comparison Study: MT vs. Original Generator

- A one-year direct comparison between the MT and original generator set will begin shortly
- Comparison will use the same gas stream in real time



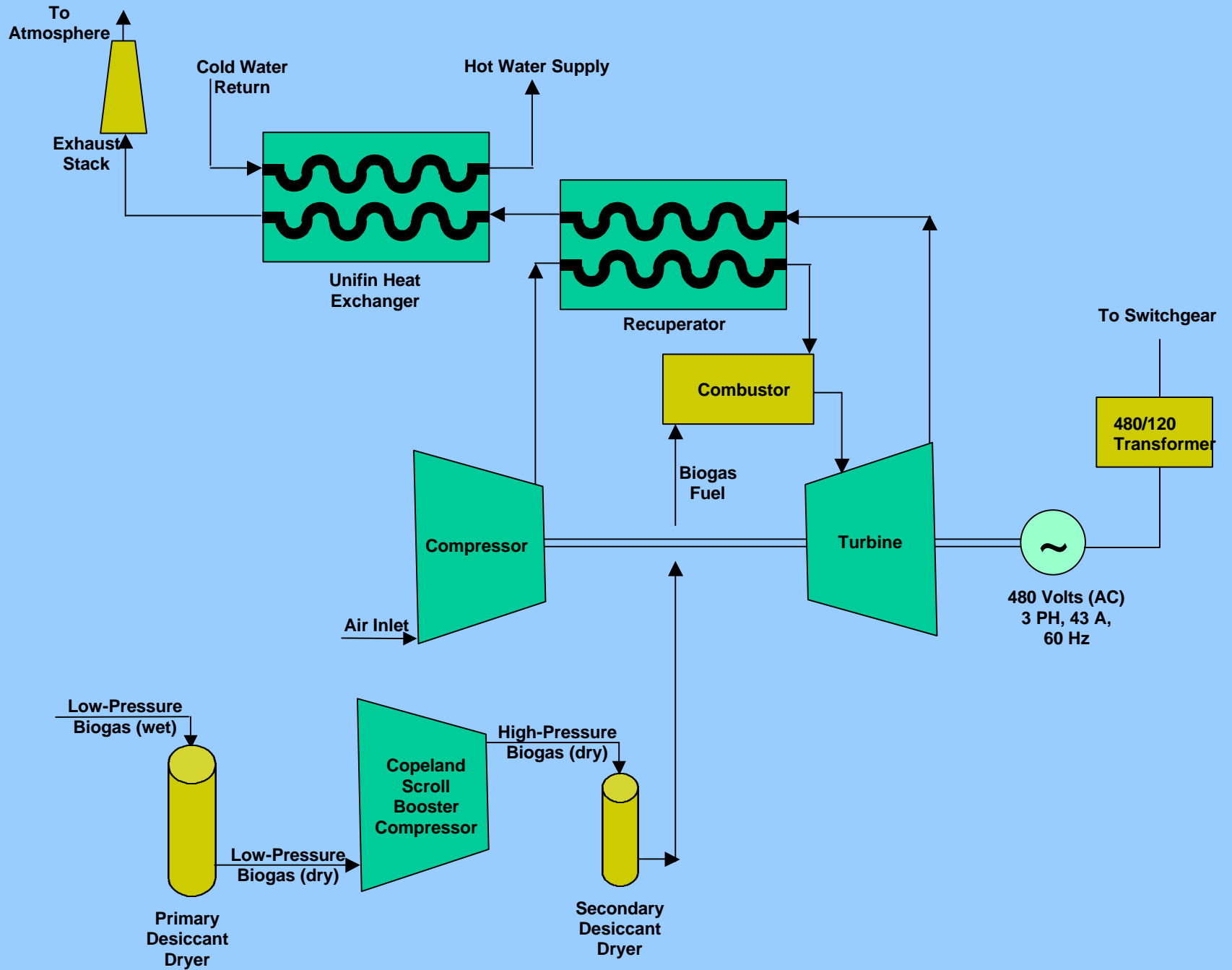
Comparison Study: Preparation

- **MT has accumulated approx 1300 runtime hours as of 6/9/02**
- **MT is being fitted with connections to its factory-installed sensors and to after-market meters and gauges for the comparison study**
- **Nearly real-time comparison readings will be available on OEMC Web site**

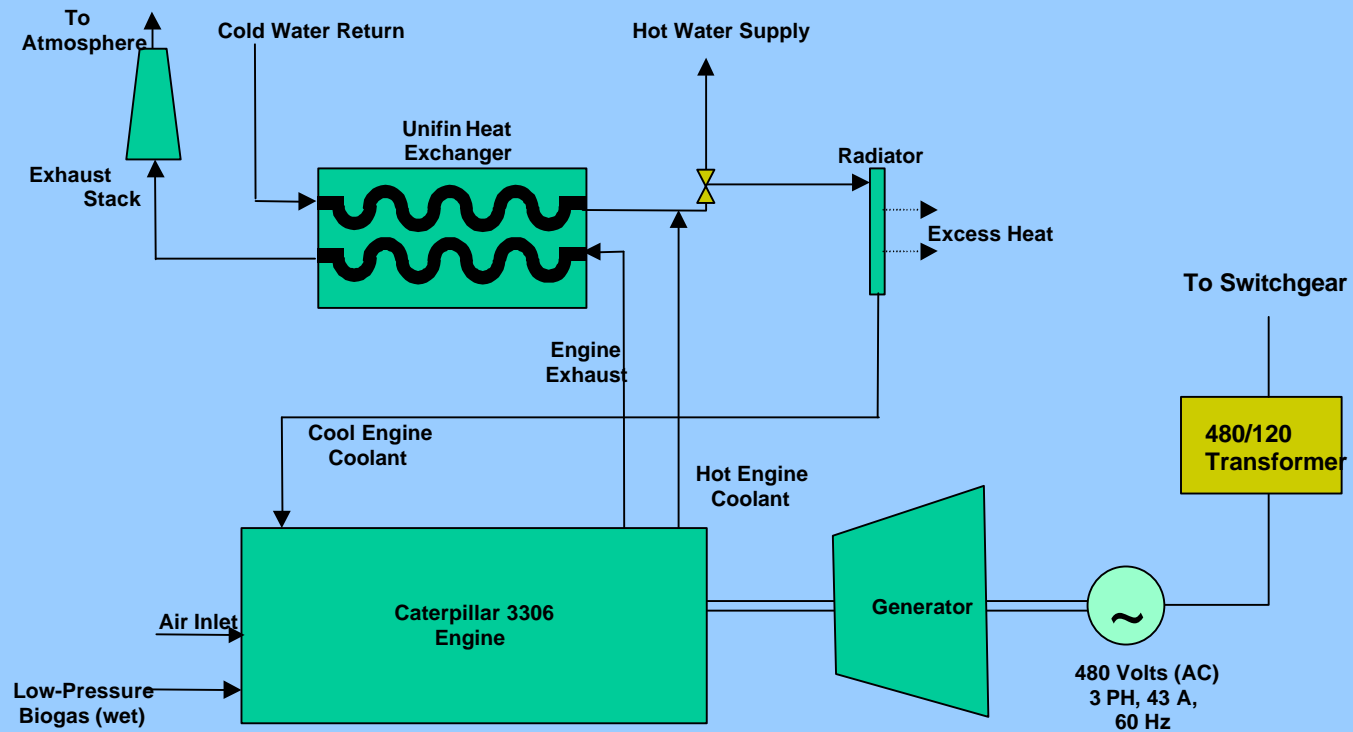
Comparison Study: Evaluation

- **Southern Research Institute (SRI), under EPA Greenhouse Gas Technology Center's Environmental Technology Verification (ETV), will conduct the study**
- **Study will determine technical, emissions and other performance measures**
- **Comparison results will be available at the end of the test and free to anyone**

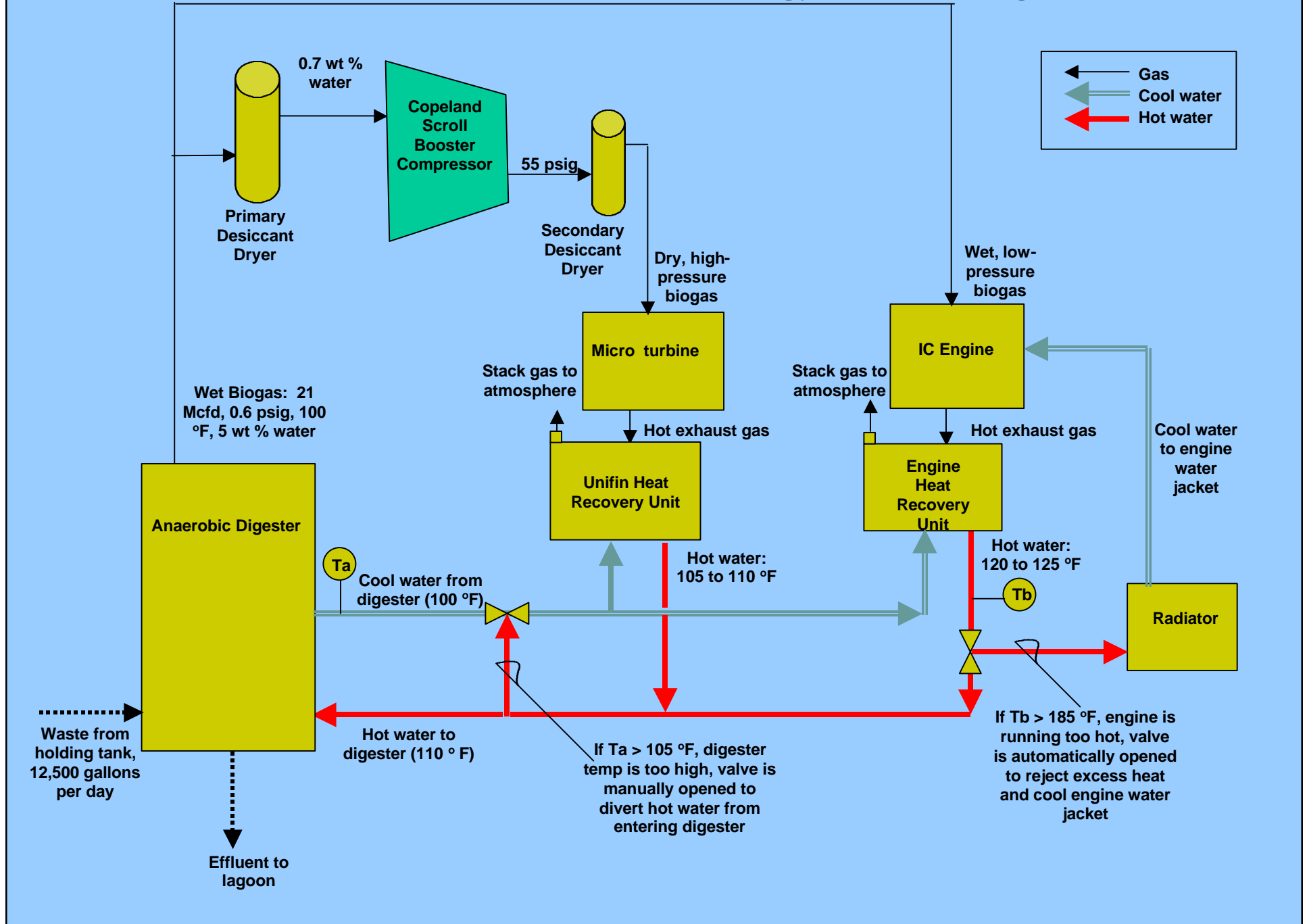
Colorado Pork Micro Turbine Schematic



Colorado Pork IC Engine Schematic



Colorado Pork Waste To Energy Process Diagram



GHG Center Measurement System at Colorado Pork

